VCE BIOLOGY 2014

YEAR 12 TRIAL EXAM

Unit 3 & Unit 4
Reading time: 15 minutes
Writing time: 2 hours 30 minutes

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	40	40	40
B	12	12	70
			Total 110

An Answer Sheet is provided for Section A
Answer all questions in Section B in the space provided

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STUDENT NUMBER

									Letter
Figures									
Words									

Student Name.....…….....

VCE Biology 2014 Year 12 Trial Exam Unit 3/4

There are **40 Multiple Choice Questions** to be answered by circling the correct letter in the table below. Use only a 2B pencil. If you make a mistake, erase it and enter the correct answer. Marks will not be deducted for incorrect answers.

Question 1	A	B	C	D	*Question 2*	A	B	C	D
Question 3	A	B	C	D	*Question 4*	A	B	C	D
Question 5	A	B	C	D	*Question 6*	A	B	C	D
Question 7	A	B	C	D	*Question 8*	A	B	C	D
Question 9	A	B	C	D	*Question 10*	A	B	C	D
Question 11	A	B	C	D	*Question 12*	A	B	C	D
Question 13	A	B	C	D	*Question 14*	A	B	C	D
Question 15	A	B	C	D	*Question 16*	A	B	C	D
Question 17	A	B	C	D	*Question 18*	A	B	C	D
Question 19	A	B	C	D	*Question 20*	A	B	C	D
Question 21	A	B	C	D	*Question 22*	A	B	C	D
Question 23	A	B	C	D	*Question 24*	A	B	C	D
Question 25	A	B	C	D	*Question 26*	A	B	C	D
Question 27	A	B	C	D	*Question 28*	A	B	C	D
Question 29	A	B	C	D	*Question 30*	A	B	C	D
Question 31	A	B	C	D	*Question 32*	A	B	C	D
Question 33	A	B	C	D	*Question 34*	A	B	C	D
Question 35	A	B	C	D	*Question 36*	A	B	C	D
Question 37	A	B	C	D	*Question 38*	A	B	C	D
Question 39	A	B	C	D	*Question 40*	A	B	C	D

VCE Biology 2014 Year 12 Trial Exam Unit 3/4

SECTION A – Multiple Choice Questions

Question 1
Which of the following elements is not found in glucose?
A. Carbon.
B. Nitrogen.
C. Oxygen.
D. Hydrogen.

Question 2
Which category of biomolecules does not form polymers?
A. Carbohydrates.
B. Lipids.
C. Nucleic acids.
D. Proteins.

Question 3
Which of the following lists of biomolecules only contains lipids?
A. Phospholipids, triglycerides, chitin.
B. Glucose, DNA, amylase.
C. Steroids, starch, triglycerides.
D. Triglycerides, steroids, phospholipids.

Question 4
The forming of polymers from the chemical bonding of monomers is a process called
A. condensation polymerisation and produces one water molecule per bond formed.
B. condensation polymerisation and absorbs one water molecule per bond formed.
C. hydrolysis and produces one water molecule per bond formed.
D. hydrolyses and absorbs one water molecule per bond formed.

*Questions 5 and 6 refer to **Figure 1**, which is an image of a haemoglobin molecule.*

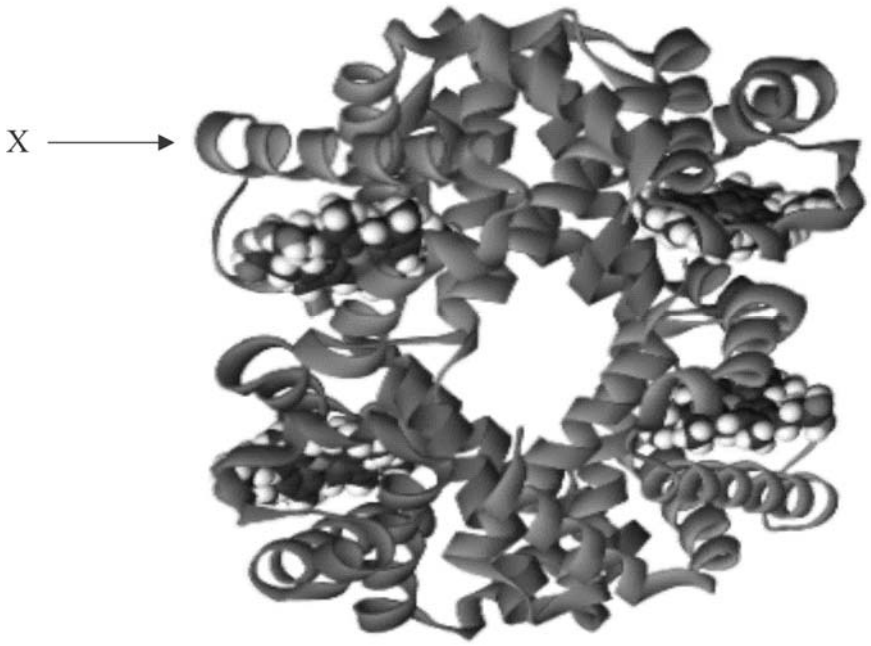

Figure 1

Question 5
Structure X is
A. a beta pleated sheet and is part of the molecule's tertiary structure.
B. an alpha helix and is part of the molecule's tertiary structure.
C. a beta pleated sheet and is part of the molecule's secondary structure.
D. an alpha helix and is part of the molecule's secondary structure.

Question 6
If the haemoglobin molecule was heated to 60°C, which level of its structure would be least affected?
A. Its quaternary structure.
B. Its tertiary structure.
C. Its secondary structure.
D. Its primary structure.

Question 7
Which of the following transport processes does not require energy?
A. Active transport.
B. Exocytosis.
C. Pinocytosis.
D. Osmosis.

Questions 8 and 9 refer to ***Figure 2****.*

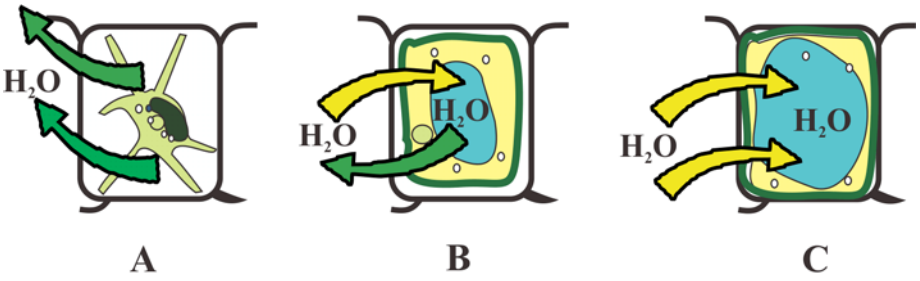

Figure 2

Question 8
A plant cell is placed in distilled water. Which of the following represents the consequence of this in terms of net water movement?
A. A.
B. B.
C. C.
D. None of the above.

Question 9
If a red blood cell was placed in distilled water, which scenario in **Figure 2** accurately reflects what would happen to this cell after 10 – 20 minutes?
A. None of the above, the cell would burst.
B. B.
C. C.
D. A.

Question 10
Which of the following is true of enzymes?
A. The active site is non-specific and can operate on a wide variety of substrates.
B. A temperature well below the enzyme's optimal temperature will reduce its rate of activity because it will change the shape of its active site.
C. Enzymes catalyse chemical reactions by reducing their activation energy.
D. Enzymes catalyse chemical reactions by increasing their activation energy.

Question 11
The process of cellular respiration is
A. anabolic and exergonic.
B. catabolic and exergonic.
C. anabolic and endergonic.
D. catabolic and endergonic.

Question 12
The Kreb's cycle occurs in the
A. cristae of the mitochondria.
B. matrix of the mitochondria.
C. ribosomes of the mitochondria.
D. thylakoid membranes of the mitochondria.

Question 13
Which of the following statements is true of photosynthesis?
A. Oxygen is produced in the light-independent reaction.
B. Carbon dioxide is a reactant in the light-dependent reaction.
C. Glucose is produced in the light-independent reaction.
D. Glucose is produced in the light-dependent reaction.

*Questions 14 – 15 refer to **Figure 3**, which represents a nerve cell.*

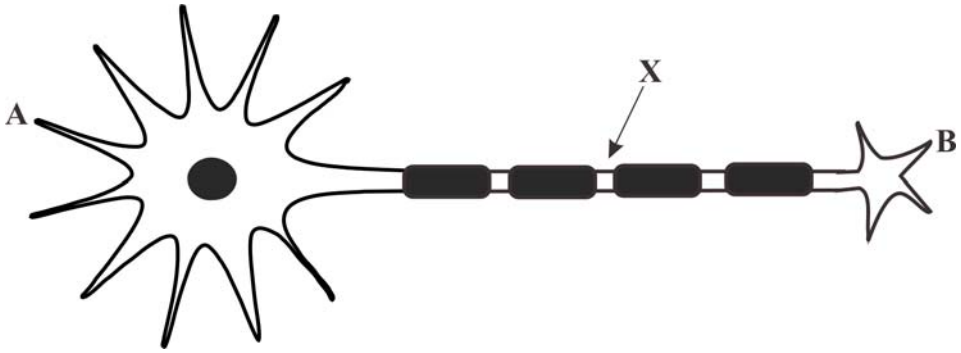

Figure 3

Question 14
The type of nerve cell depicted in **Figure 3** is
A. a sensory neuron.
B. a motor neuron.
C. an interneuron.
D. none of the above.

Question 15
Which of the following list of terms matches the structures A, X and B, in that order?
A. Dendrite, axon, axon terminal.
B. Axon, axon terminal dendrite.
C. Axon terminal, axon, dendrite.
D. Axon, dendrite, axon terminal.

Question 16
The signalling molecules that cross the synaptic gap are called
A. second messengers.
B. neurotransmitters.
C. pheromones.
D. histamines.

Question 17
The first line of defence of the human immune system includes
A. the inflammatory response.
B. intact skin.
C. natural killer cells.
D. helper T cells.

Question 18
T cells mature in the
A. tonsils.
B. bone marrow.
C. spleen.
D. thymus.

Question 19
Which of the following cells do not form part of the non-specific immune system?
A. Plasma cells.
B. Basophils.
C. Mast cells.
D. Macrophage.

Question 20
Which of the following is a correct statement in regard to humoral immunity?
A. T helper cells activate cytotoxic T cells to destroy foreign eukaryotic cells.
B. B cells, after coming into contact with a specific antigen and being activated, produce memory cells which fight the infection.
C. B cells, after coming into contact with a specific antigen and being activated, undergo clonal expansion, creating plasma cells that produce antibodies specific to the antigen.
D. B cells, after coming into contact with a specific antigen and being activated, produce antibodies specific to the antigen.

Questions 21 and 22 refer to the information below.
A structure containing the following nitrogenous base sequence is observed to leave the nucleus:

AUUCGGGGUCUCGGG

Question 21
This structure would be categorised as
A. mRNA.
B. a chromosome.
C. DNA.
D. a gene.

Question 22
The first three letters will code for
A. a protein.
B. a ribosome.
C. an amino acid.
D. a carbohydrate.

Question 23
Mitochondrial DNA is
A. linear and double stranded.
B. linear and single stranded.
C. circular and double stranded.
D. circular and single stranded.

Question 24
Which stage of mitosis does **Figure 4** represent?

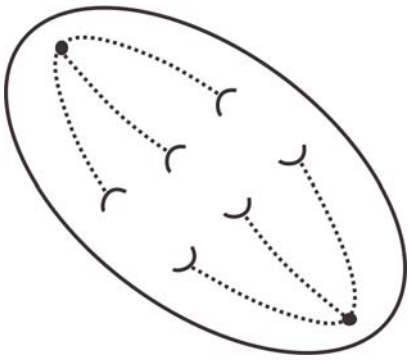

Figure 4

A. Prophase.
B. Telophase.
C. Metaphase.
D. Anaphase.

Question 25
In humans, mitosis involves the creation of two
A. diploid somatic cells.
B. diploid gametes.
C. haploid somatic cells.
D. haploid gametes.

*Questions 26 and 27 refer to the pedigree in **Figure 5**.*

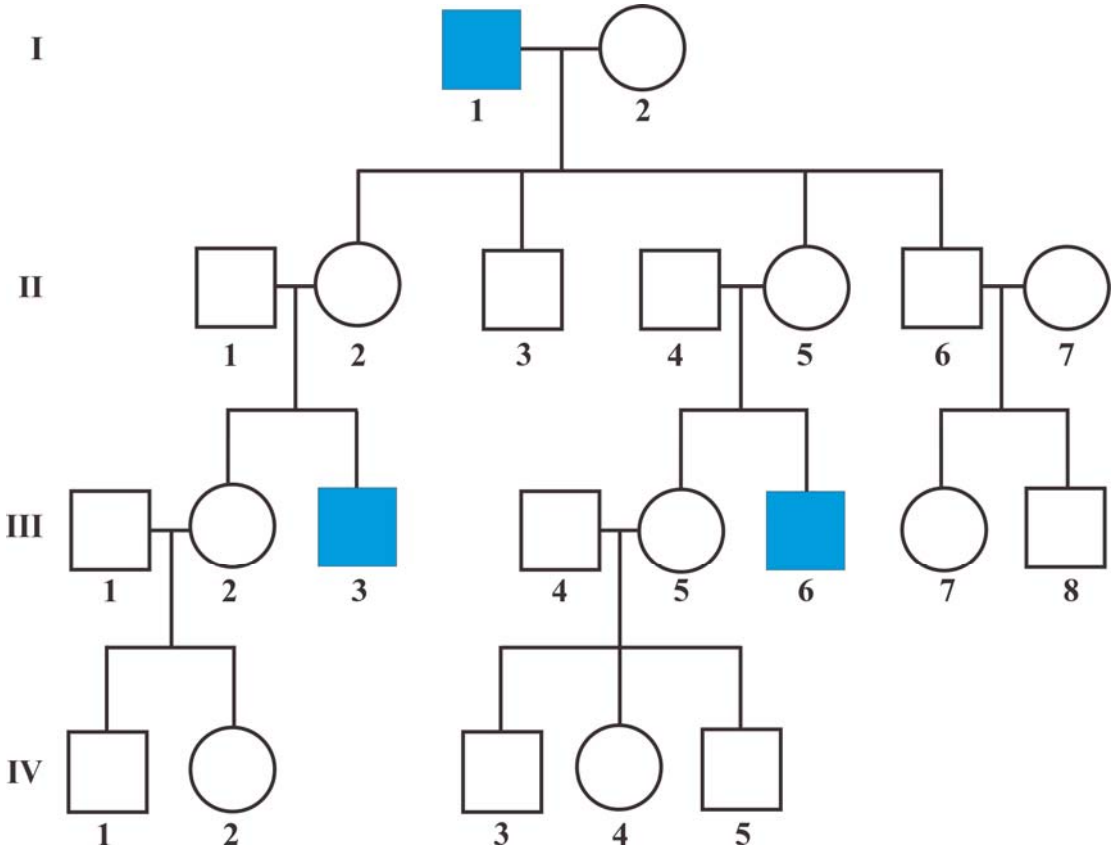

Figure 5

Question 26
The mode of inheritance of the condition in the pedigree would most likely be
A. X-linked recessive.
B. X-linked dominant.
C. autosomal recessive.
D. autosomal dominant.

Question 27
Concerning the genotype of the alleles involved in this condition, individual II5 must be
A. heterozygous.
B. homozygous.
C. hemizygous.
D. codominant.

Question 28

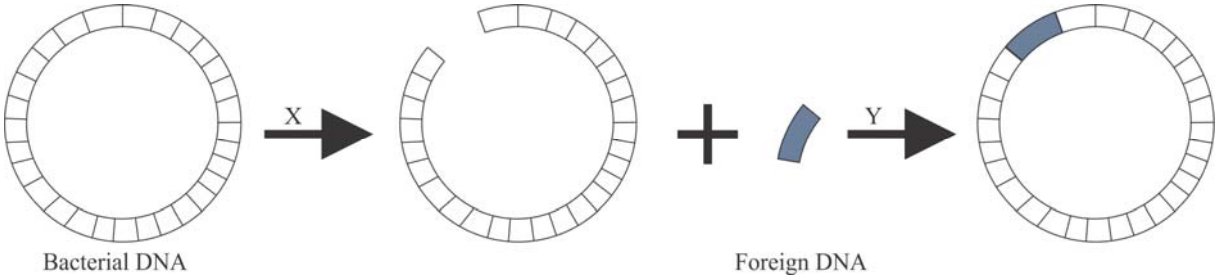

Figure 6

In the process depicted in **Figure 6**, X and Y respectively would be

A. DNA ligase and DNA polymerase.
B. an endonuclease and DNA ligase.
C. an endonuclease and helicase.
D. DNA ligase and an endonuclease.

Question 29

In a species of South African turtle, a green shell is the dominant phenotype and a grey shell is the recessive phenotype. If two green shell turtles are crossed and produce two offspring with grey shells and another two offspring with green shells, then it would be reasonable to conclude that

A. the parent turtles are homozygous dominant at this locus.
B. the parent turtles are heterozygous at this locus.
C. the parent turtles are homozygous recessive at this locus.
D. it is not possible to determine the parent's genotype from this information.

Question 30

A cat has black fur and green eyes. These are both dominant phenotypes of their respective characteristics and the genes involved are located on autosomes. The alleles involved in respect to fur colour are B for black and b for white, while the alleles involved in respect to eye colour are G for green and g for blue. The two genes are not linked. In order to determine the genotype of the cat it would be necessary to cross it with a cat with the following genotype

A. BBGG.
B. BbGG.
C. BbGg.
D. bbgg.

Question 31

Down's syndrome is caused most typically by non-disjunction during meiosis causing an extra chromosome 21 being present in all cells of the affected individual. The best method to check for this condition in a foetus is with which analysis technique?

A. DNA sequencing.
B. DNA hybridization.
C. Observation of morphological features.
D. Karyotyping.

Question 32
The diagram in **Figure 7** represents the evolutionary history of some mammal species.

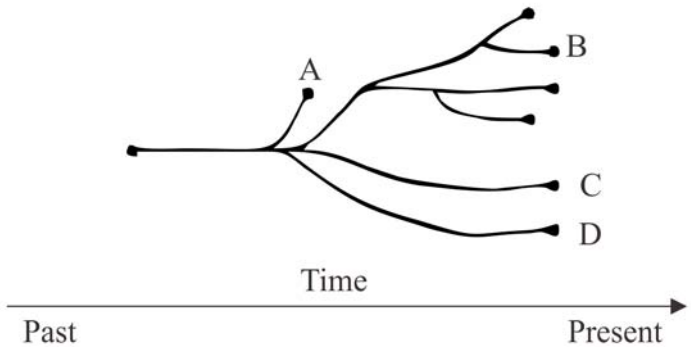

Figure 7

The diagram shows that
A. species A is a common ancestor of species B, C and D.
B. species B and C are more closely related than species C and D.
C. species C and D are more closely related than species B and C.
D. species A, B, C and D are all alive at present.

Question 33
A human bone was found in a cave and its carbon-14 content was analysed in order to date it. It was found that 1/8 of its original carbon-14 content remained. The half-life of carbon 14 is 5730 years. How old is the bone?
A. 11460 years.
B. 17190 years.
C. 22920 years.
D. 28650 years.

Question 34
Natural selection has the following effect on the mutation rate of a population:
A. it increases the rate.
B. it decreases the rate.
C. it has no effect on the rate.
D. it stops mutations occurring.

Question 35
Which of the following categories of stem cells are the most powerful in terms of their ability to differentiate into all cell types?
A. Totipotent.
B. Pluripotent.
C. Multipotent.
D. Omnipotent.

Question 36
Figure 8 represents the cloning process that produced Dolly the sheep.

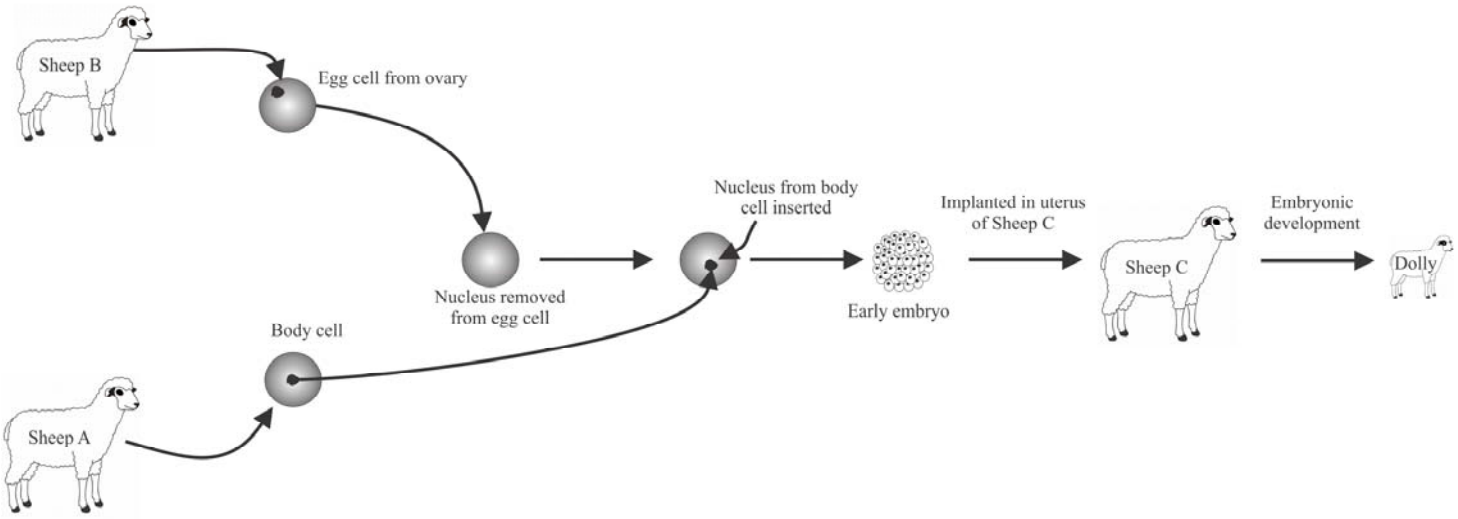

Figure 8

In regard to this process, which of the following statements is accurate?
A. Dolly has nuclear genes derived from sheep A, B and C.
B. In regard to her nuclear genes, Dolly will have a unique genotype, different from sheep A, B and C.
C. Dolly will have a mix of nuclear genes from sheep A and B.
D. Dolly will have nuclear genes derived only from sheep A.

Question 37
The Australian echidna is a monotreme mammal and North American porcupine is a placental mammal. The two mammals look very similar and occupy similar niches in their respective habitats. The process that has produced this similarity is
A. divergent evolution.
B. convergent evolution.
C. artificial selection.
D. coevolution.

Question 38
If an organism is a hominin then it is also a hominid. Hominins are distinguishable from other hominids because they
A. are bipedal.
B. are less hairy.
C. have nails.
D. live both in Africa and in other parts of the world.

Question 39
The diagram in **Figure 9** shows the similarity in skeletal structure of the limbs of various mammals.

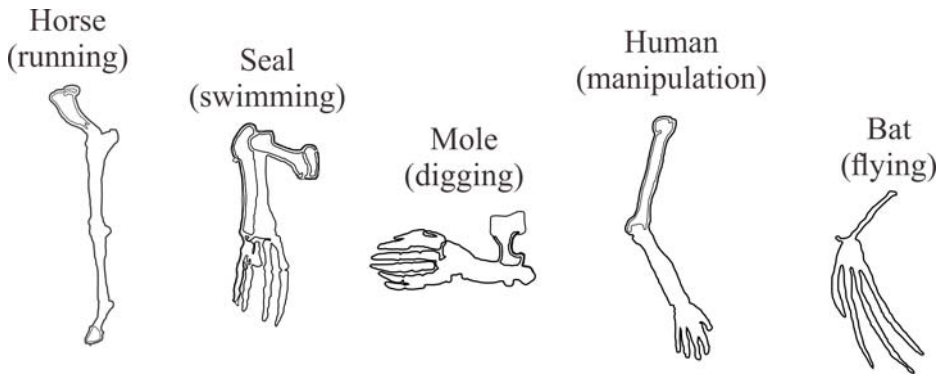

Figure 9

Such similarity provides strong evidence of evolution because it
A. indicates that these mammals share a common ancestor that has subsequently evolved in different directions.
B. shows that similar skeletal structures can perform different functions.
C. suggests that limbs must have a specific skeletal structure to be useful.
D. highlights the similarities and differences of mammals.

Question 40
After recent analysis of human mitochondrial DNA, it has been concluded that all Europeans are descended from 200 people or less. This could be an example of
A. genetic drift.
B. a population bottleneck.
C. natural selection.
D. allopatric speciation.

End of Section A

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SECTION B – Short Answers Questions

Question 1 (6 marks)

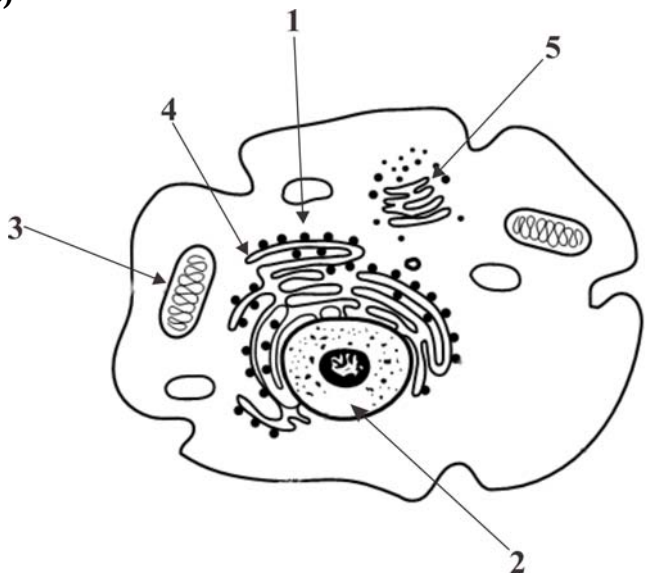

Figure 10

Figure 10 is a cell that is responsible for manufacturing and secreting an important hormone.

a. Name each numbered structure and provide details of its contribution to this role. **5 marks**

Name	**Contribution to manufacture and secretion of hormone**
1:	
2:	
3:	
4:	
5:	

b. Define the term hormone. **1 mark**

_____

_____

_____

Question 2 (4 marks)
Malaria is caused by protozoan parasites from the genus *Plasmodium.* These pathogens have many lifecycle stages; both in humans and in their mosquito vector. Drugs used to combat malaria have been ineffective at completely removing the parasites involved as they can hide in the liver and the bloodstream at certain points in their lifecycle. Furthermore, malaria parasites have become increasingly resistant to the drugs. Scientists have recently reported that a new drug is being trialled that can defeat these protozoa at all stages of their lifecycle by disabling the enzyme PI(4)K which is essential for the transportation of lipids across the cell membrane. This enzyme is required at all stages of the pathogens lifecycle.

a. What type of biomolecule is an enzyme? **1 mark**

_____

_____

_____

b. What is the role of enzymes in organisms? **1 mark**

_____

_____

_____

c. Explain how the protozoan parasites become resistant to malaria drugs. **1 mark**

_____

_____

_____

d. Suggest one way the new drug might disable the PI(4)K enzyme. **1 mark**

_____

_____

_____

Question 3 (6 marks)
There are several species of sacoglossan sea slugs that are known to feed on unicellular algae and to visibly store the alga's chloroplasts. This gives the slugs an unusual green colour. Scientists have been trying to establish whether the slugs derive energy from photosynthesis in these stored chloroplasts.

a. If it was found that photosynthesis was occurring in these stored chloroplasts, it would make these slugs unique in that they would be the only known animals that directly utilise what form of energy to make their food? **1 mark**

_____

_____

b. What other inputs would be required for the slug to successfully photosynthesise? **1 mark**

_____

_____

_____

c. Scientists have also hypothesised that, should these slugs be photosynthesizing, they might be able to live in anaerobic conditions. Suggest a reason for the formulation of this hypothesis. **1 mark**

_____

_____

_____

d. When deciding on what could be measured for clear evidence of photosynthesis, one suggestion was to look for the build-up of NADH in the slug's tissue. Explain whether this was a good suggestion or not. **2 marks**

_____

_____

_____

Once it is determined that photosynthesis is occurring in the slugs, then it would be important to establish that the glucose produced contributed to the slugs' diet.

An experiment on the slug species *E. timida* involved the following procedure: The slugs were split into three groups, all being starved. One group lived in light, one group lived in the dark and one group had their photosynthesis cut off chemically. After 49 days, all slugs showed the same amount of weight loss.

e. What conclusion can be made from these results? **1 mark**

_____

_____

Question 4 (6 marks)

The diagram in **Figure 11** depicts the process of DNA replication.

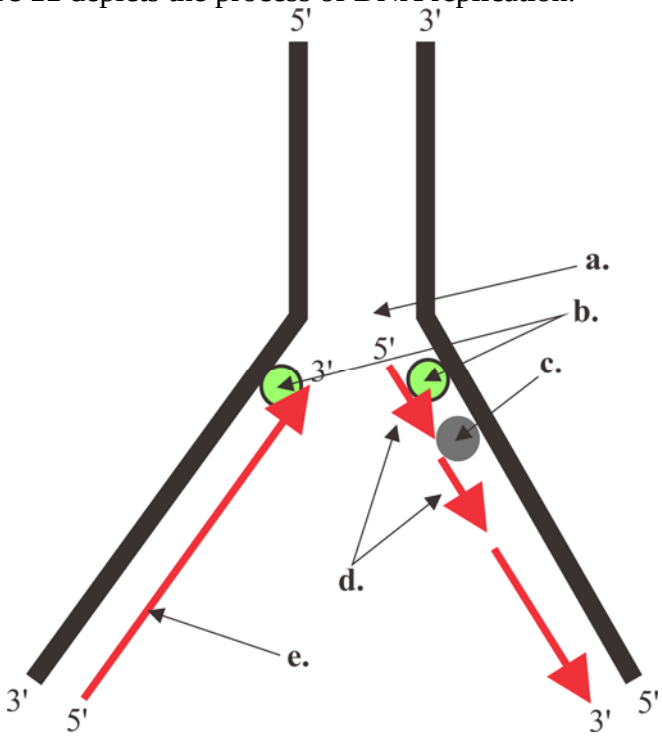

Figure 11

a. Provide a label for the following parts of the diagram: **5 marks**
(1 mark each)

a.: _____

b.: _____

c.: _____

d.: _____

e.: _____

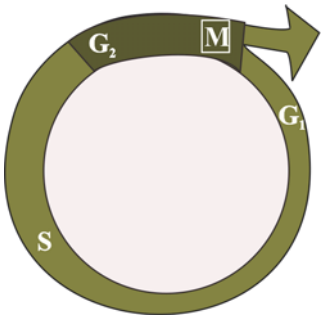

Figure 12

b. **Figure 12** represents the cell cycle. In which phase of this cycle does DNA replication occur? **1 mark**

_____

Question 5 (7 marks)
The diagram in **Figure 13** represents a synapse in the nervous system.

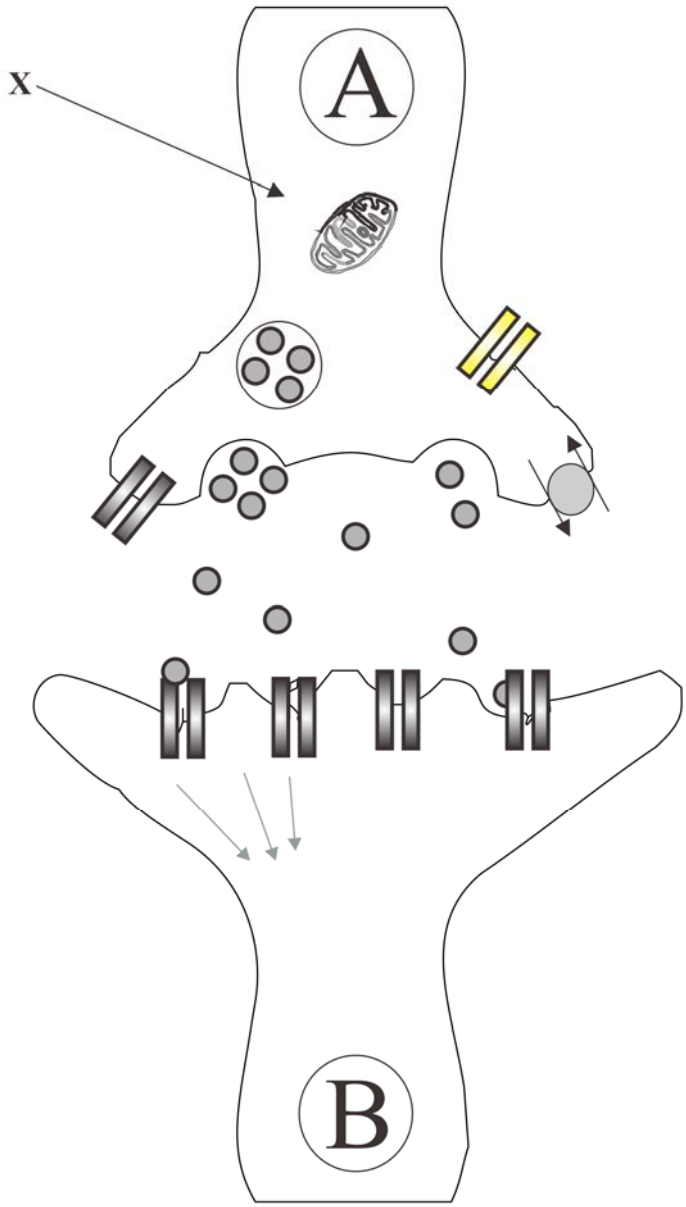

Figure 13

a. What is the function of a synapse? **1 mark**

_____

_____

b. In **Figure 13** name Structure X, and explain the contribution it makes in this context. **2 marks**

_____

_____

_____

_____

c. Describe a signal transduction event in this synapse. **2 marks**

_____

_____

_____

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_____

Tetanus is a condition caused by an infection of the bacterium *Clostridium tetani*. The primary symptoms are muscular spasms caused by a neurotoxin released by the bacterium.

d. Suggest how this neurotoxin causes uncontrolled muscular spasm when introduced into a synapse. **1 mark**

_____

_____

_____

_____

e. Suggest one way a tetanus infection could be prevented. **1 mark**

_____

_____

Question 6 (5 marks)

A species of plant has purple flower petals and it is observed to usually grow in slightly acidic soil. The plant is observed to produce yellow flowers on occasion. Scientists want to know if soil pH affects the colour of the flowers.

a. What is the hypothesis that is to be tested in this scenario? **1 mark**

_____

_____

_____

b. What would the dependent and independent variable be in the experimental design? **1 mark**

_____

_____

_____

c. Provide an outline of a controlled experiment that would test the hypothesis. Include a result that would support the hypothesis. **3 marks**

_____

_____

_____

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Question 7 (5 marks)
AIDS is an infectious disease that remains an epidemic in many parts of the world. It is caused by the Human immunodeficiency virus, which eludes the immune system by infecting and ultimately killing T cells. Many drugs have been developed to combat HIV but a cure has been difficult to find.

a. What is a virus? **2 marks**

_____

_____

_____

_____

b. AIDS stands for acquired immunodeficiency syndrome. Explain how a HIV infection can lead to AIDS. **2 marks**

_____

_____

_____

_____

c. Even though many drugs have initially been effective against HIV, they have not ultimately been able to prevent the infection. Explain why this happens. **1 mark**

_____

_____

_____

_____

_____

Question 8 (6 marks)

Anaphylaxis is a serious allergic reaction that occurs rapidly and can be fatal. Symptoms include an itchy rash, swelling of the throat and low blood pressure. The causes are varied but include certain foods such as peanuts and shellfish, some bites and stings and some medications. Treatment is the injection of epinephrine.

a. Based on the symptoms, what immune response is being activated when anaphylaxis occurs? **1 mark**

_____

_____

b. If a person's anaphylactic trigger is peanuts and the person ingests peanuts, describe the steps involved that lead to the symptoms described above. **3 marks**

_____

_____

_____

_____

_____

_____

_____

c. Explain how this person would have become initially sensitised to peanuts. **2 marks**

_____

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_____

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_____

Question 9 (7 marks)
The family pedigree of a rare disease is shown in **Figure 14**.

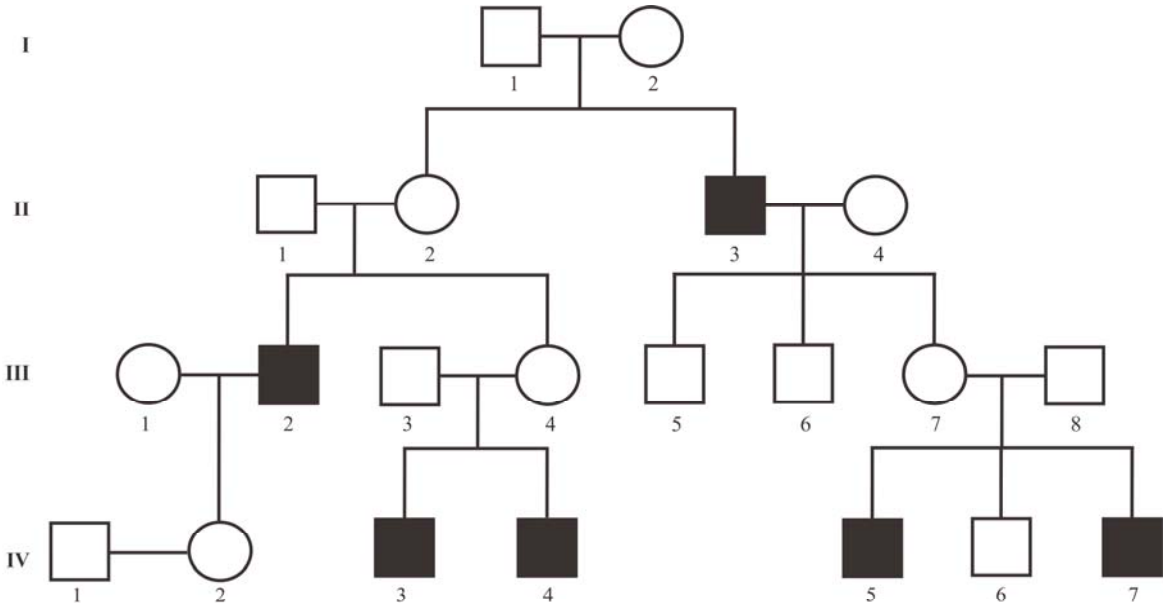

Figure 14

a. What is the most likely mode of inheritance of this disease? Explain your answer. **2 marks**

_____

_____

_____

_____

b. With respect to the allele that causes this disease, what are the genotypes of I1 and I2? Explain your answer. **2 marks**

_____

_____

_____

_____

c. If IV1 and IV2 have a child, what is the probability that it will inherit the disease? Provide your reasoning. **2 marks**

_____

_____

_____

_____

d. How would this disease have originated in this family? **1 mark**

_____

_____

_____

Question 10 (8 marks)
A scientist studying the fruit fly *Drosophila melanogaster* had one specimen with wild type wings and one with vestigial wings.

a. What is meant by the term 'wild type'? **1 mark**

_____

_____

_____

b. Assign appropriate allele symbols for this trait. **1 mark**

_____

_____

c. The scientist wanted to determine the genotype of the fly with wild type wings. Using Punnett squares, show the crosses necessary to determine this and provide the expected genotypic and phenotypic ratios of the offspring in the two possible scenarios. **4 marks**

The scientist is interested to find out whether this wing allele is linked to the allele concerning eye colour – red coloured eyes being dominant and white coloured eyes being recessive. In order to investigate this she crossed heterozygous flies for wing type and eye colour with homozygous recessive flies for wing type and eye colour and analysed 100 offspring. Out of the four expected genotypes, their respective numbers were 40, 40, 10, 10. The scientist concluded that the genes were not linked.

d. Do you agree with the scientist? Explain your reasoning. **2 marks**

Question 11 (5 marks)

Comb jellyfish have a gelatinous body and general appearance like other jellyfish however they do not belong in their cnidarian taxonomic group. The important difference is that comb jellyfish have a relatively sophisticated nervous system including a rudimentary brain and synapses between nerve cells. Cnidarian jellyfish only have a loose network of nerve cells. Their evolutionary history goes back at least 559 million years. It has commonly been thought that comb jellyfish nervous systems are ancestral to those of modern animals. Comb jellyfish are notably different from sponges as they contain endoderm and ectoderm layers in early embryonic development. The ectoderm differentiates to form various structures including the nervous system.

a. Why is fossil evidence of ancient jellyfish extremely rare? **1 mark**

The diagram in **Figure 15** illustrates the presumed evolutionary relationship between comb jellyfish and other ancient aquatic animals, based on anatomical analysis. The black dots refer to when the specific trait evolved.

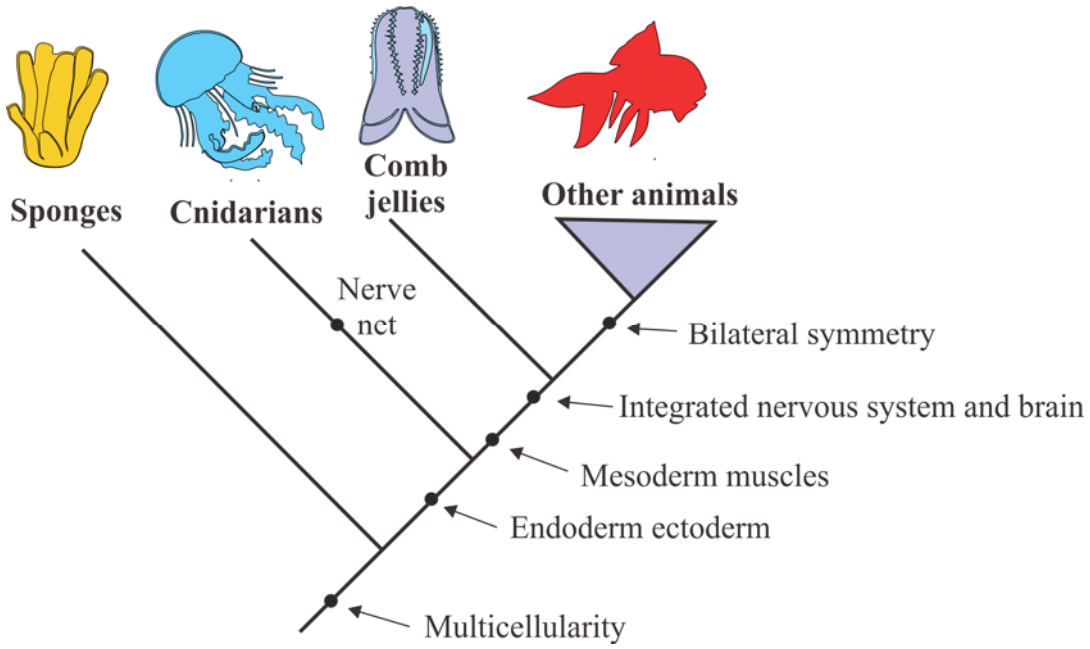

Figure 15

b. Does the diagram above suggest that sponges, cnidarians and comb jellies are ancestral to other, later, animals? Explain your answer. **1 mark**

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_____

_____

Recent genetic analysis shows that many highly conserved, and thus important, gene families in animals are present in cnidarians and other animals but not in comb jellies and sponges. One of these gene families is the HOX genes, which are involved in development of body parts and the overall body plan. The lack of HOX genes in sponges was not surprising but was totally unexpected in comb jellyfish.

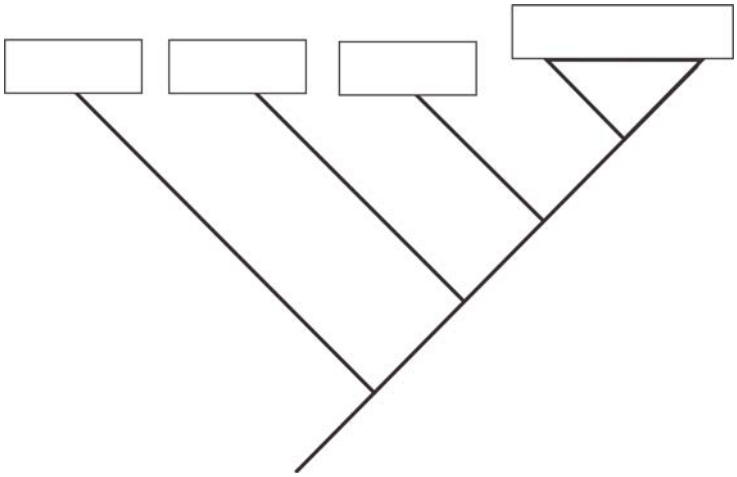
c. Why would it be unexpected for comb jellyfish not to have HOX genes? **1 mark**

_____

_____

_____

d. By filling in the boxes below only, change the evolutionary tree so that it reflects this genetic discovery. **1 mark**



Further genetic analysis revealed that the comb jellyfish genome doesn't contain the genes responsible for the nervous system of all other animals. Scientists have not been able to locate the genes responsible for the comb jellyfish's nervous system because they don't know what to look for. This is despite the fact that these jellyfish have nerve cells, muscles and a rudimentary brain.

e. When reflecting on the comparison between the nervous systems of comb jellyfish and of other animals, what type of evolution seems to have occurred? **1 mark**

_____

_____

Question 12 (5 marks)

Recent findings of hominin fossils in Georgia (a country in Eastern Europe) have cast doubts on our understanding of human evolution. Four skulls have been unearthed in a cave, which are believed to belong to *Homo erectus*, despite displaying a huge amount of variation. The variation is so great that scientists are wondering whether the other ancient species in the *Homo* genus might not actually be variants of *Homo erectus* as well, rather than separate species.

a. Part of the problem of resolving the events in human evolution is the rarity of fossils. Suggest why hominin fossils are found so rarely. **2 marks**

_____

_____

_____

b. Give an example of an ancient species in the genus '*Homo*', other than *Homo erectus*, and suggest an anatomical difference that would be found in their respective fossils. **1 mark**

_____

_____

_____

_____

_____

c. Why is it difficult to determine whether two or more fossils belong to the same species? **1 mark**

_____

_____

_____

The genus '*Homo*' is believed to have evolved from the genus '*Australopithecus*'.

d. Suggest a major anatomical feature that differentiates members of the genus *Homo* from members of the genus *Australopithecus*. **1 mark**

_____

End of Section B

End of Trial Exam

Suggested Answers

VCE Biology 2014 Year 12 Trial Exam Unit 3/4

SECTION A – Multiple Choice Answers

1. B	**2.** B	**3.** D	**4.** A	**5.** D	**6.** D	**7.** D	**8.** C	**9.** A	**10.** C
11. B	**12.** B	**13.** C	**14.** B	**15.** A	**16.** B	**17.** B	**18.** D	**19.** A	**20.** C
21. A	**22.** C	**23.** C	**24.** D	**25.** A	**26.** A	**27.** A	**28.** B	**29.** B	**30.** D
31. D	**32.** B	**33.** B	**34.** C	**35.** A	**36.** D	**37.** B	**38.** A	**39.** A	**40.** B

SECTION B - Short Answer (Answers)

Question 1 (6 marks)

a. **(1 mark per row for a total 5 marks)**

Name	**Contribution to manufacture and secretion of hormone**
1: ribosome	Site of protein manufacture: translates mRNA into primary protein structure of the hormone.
2: nucleus	Contains DNA code for the hormone and is the site of transcription where the DNA code is transcribed into mRNA copy.
3: mitochondria	Provides energy for the energy requiring processes in the manufacture and secretion of the hormone.
4: rough endoplasmic reticulum	Transports the hormone to the golgi body.
5: golgi body	Concentrate the hormone, possibly modify it and package it into vesicles so that it can be secreted via exocytosis.

b. A hormone is a chemical secreted by one cell that has an effect on another cell containing a hormone specific receptor **(1 mark)**.

Question 2 (4 marks)

a. Protein **(1 mark)**.

b. Enzymes are catalysts for chemical reactions and work by lowering the activation energy of the reactions **(1 mark)**.

c. The drugs kill many of the parasites but due to their genetic variation some are naturally resistant to the drugs. They survive and multiply creating drug resistant strains of the parasite **(1 mark)**.

d. The drug might block the active site on the enzyme so that the substrate does not have access to it. (or any other reasonable answer explaining how the active site is rendered non-functional) **(1 mark)**.

Question 3 (6 marks)

a. Light energy **(1 mark)**.

b. Carbon dioxide and water **(1 mark)**.

c. The slugs might utilise the oxygen produced in photosynthesis for aerobic respiration and therefore would not require oxygen to be present in their surrounding environment **(1 mark)**.

d. It was not a good suggestion as NADH is produced in the light dependent reaction and then used up in the light independent reaction **(1 mark)**, thus it would be absent from the slug's surrounding tissue regardless of photosynthesis occurring or not **(1 mark)**.

e. The glucose produced by photosynthesis does not contribute to the slug's diet **(1 mark)**.

Question 4 (6 marks)

a. **1 mark each for a total (5 marks)**.

a.: replication fork
b.: DNA polymerase
c.: DNA ligase
d.: okazaki fragments
e.: leading strand

b. S phase **(1 mark)**

Question 5 (7 marks)

a. The synapse is a small gap separating neurones and neurones or neurones and effector organs. It provides a pathway across which an electrochemical signal to travel from one nerve cell to another, or from a nerve cell to a muscle or gland **(1 mark)**.

b. The structure labelled X is a mitochondrion **(1 mark)**. It provides energy for the cell and specifically, in this context, provides energy for the release of neurotransmitters into the synaptic gap via the energy requiring process of exocytosis **(1 mark)**.

c. Neurotransmitters diffuse across the synapse and bind to specific receptors on the post synaptic membrane **(1 mark)**. A second messenger molecule is then activated on the inside of the post synaptic membrane causing a chemical cascade that results in membrane ion channels opening to allow sodium ions to diffuse in and generate a new action potential **(1 mark)**.

d. The neurotoxin might bind to the neurotransmitter receptor on the post synaptic membrane causing unintentional action potentials to be generated and thus involuntary muscular contractions **(1 mark).**

e. A tetanus vaccine could prevent a tetanus infection (or avoiding contact with the tetanus causing bacterium) **(1 mark)**.

Question 6 (5 marks)

a. If the soil is slightly acidic then the plant will produce purple flowers **(1 mark)**.

b. Dependent variable – flower colour, independent variable – soil pH **(1 mark)**.

c. Three experimental groups of ten plants each are grown in soil of the following pH levels: pH1, pH5, pH9. The plants must be of the same species and factors such as amount of water, soil type and light exposure must remain constant **(1 mark)**. (or a similar arrangement).
Once the plants have grown the colour of the flowers on each plant is noted **(1 mark)**.
The result that supports the hypothesis is that the flowers on the plants in pH 5 soil are purple, while the flowers on the plants in soils of pH 1 and pH 9 are yellow **(1 mark)**.

Question 7 (5 marks)

a. A virus is a particle consisting of genetic material surrounded by a protein coat **(1 mark)**. It can only reproduce inside a host cell **(1 mark)**.

b. HIV infects and kills T cells, meaning the specific immune system is compromised **(1 mark)**. Without T helper cells to activate B cells, there will be no humoral response to infections **(1 mark)**.

c. There is genetic variation among the millions of HIV particles due to mutation. A new drug will initially destroy most of them but the small number containing drug resistant phenotypes will remain and continue to reproduce **(1 mark)**.

Question 8 (6 marks)

a. The inflammatory response **(1 mark)**.

b. Once ingested, the problematic chemical constituent of peanuts binds to IgE immunoglobulins (or antibodies) that are attached to the surface of mast cells **(1 mark)**. This causes the mast cells to release histamines which initiate an inflammatory response **(1 mark)**. The resultant inflammatory response includes the capillaries in the area vasodilating and becoming more permeable, allowing plasma and phagocytes to leak into the tissue causing swelling, itching and low blood pressure **(1 mark)**.

c. The first time peanuts were ingested, specific B cells would have recognised the problematic peanut chemical and, after being activated by T helper cells, would have undergone clonal expansion into plasma cells and antibodies specific to the peanut chemical would have been produced **(1 mark)**. These antibodies would have then attached themselves to mast cells making the mast cells sensitive to the peanut chemical **(1 mark)**.

Question 9 (7 marks)

a. The condition is X-linked recessive **(1 mark)** because only males (II3, III2, IV3, IV4, IV5, IV7) have the condition and unaffected female carriers (I2, II2, III4, III7) have affected sons (II3, III2, IV3, IV4, IV5, IV7) **(1 mark)**.

b. The genotype for I1 must be XY while for I2 the genotype is X^aX. (X = normal X chromosome, X^a = X chromosome bearing disease causing allele) I1 has a normal X chromosome as the disease is x-linked recessive and he doesn't have the disease **(1 mark)**. I2 is heterozygous as she has an affected son and therefore must pass on a disease chromosome although she herself doesn't have the disease **(1 mark)**.

c. 25% **(1 mark)**. IV2 is a carrier and there is 50% chance that she will pass on her disease X chromosome and there is another 50% chance that they will have a boy **(1 mark)**.

d. The origin of the disease would have been a genetic mutation in a germ line cell **(1 mark)**.

Question 10 (8 marks)

a. Wild type refers to the most common phenotype of a species as it occurs in nature **(1 mark)**.

b. W – wild type wings, w – vestigial wings **(1 mark)**.

c. **(1 mark)**.

Gametes	**w**	**w**
W	Ww	Ww
w	ww	ww

Genotypes: 50% Ww, 50% ww

Phenotypes: 50% wild type wings , 50% vestigial wings

(1 mark).

Gametes	**w**	**w**
W	Ww	Ww
W	Ww	Ww

Genotypes: 100% Ww **(1 mark)**.

Phenotypes: 100% wild type wings **(1 mark)**.

d. No **(1 mark)** because this is not the expected offspring ratio for unlinked genes. The expected ratio would be: 1:1:1:1 for this cross. The fact that ratio differs significantly from this (4:4:1:1) suggests the alleles are linked and that a crossing over event may have occurred **(1 mark)**.

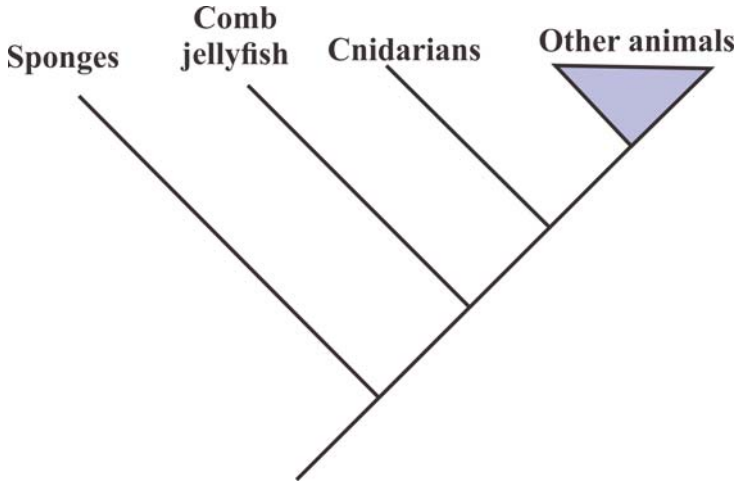
Question 11 (5 marks)

a. Jellyfish have no hard parts in which to fossilize **(1 mark)**.

b. No, they are not ancestral to later animals. The diagram suggests they all share common ancestors with later animals **(1 mark)**.

c. It is unexpected because comb jellyfish have body parts and a body with different sections and thus would appear to require HOX genes **(1 mark)**.

d.



(The order of sponges and comb jellyfish could be reversed and the answer would still be correct) **(1 mark)**.

e. Convergent evolution **(1 mark)**.

Question 12 (5 marks)

a. For a fossil to form, the hominin needed to die in the right environmental conditions which were uncommon **(1 mark)** and, if fossilisation occurred, the chance of the fossil being found is very low **(1 mark)**.

b. *Homo habilis* or another reasonable example – would have been shorter than *Homo erectus* or would have had a smaller brain case than *Homo erectus* or another reasonable answer **(1 mark)**.

c. The standard definition of a species relies on being able to assess whether individuals can successfully produce viable offspring. This definition cannot be relied upon when assessing fossil species identity **(1 mark)**.

d. Members of the genus *Homo* had larger brain cases/were taller/had less protruding jaws/had a parabolic arrangement of teeth/or another reasonable answer **(1 mark)**.

End of Suggested Answers